# Erasion, Excision and Amputation in Joint Disease.

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Read in the Section on Surgery and Anatomy, at the Forty-sixth
Annual Meeting of the American Medical Association, at
Baltimore, Md., May 7-10, 1895.

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# ERASION, EXCISION AND AMPUTATION IN JOINT DISEASE.

From failure of early diagnosis, from lack of early treatment, and from the neglect of early protection and fixation of inflamed joint surfaces, or on account of the intensity of the tubercular process, a large number of cases of tubercular joint disease still require operative procedures for the safety of the limb or the life of the affected individual. Fortunately, owing to a better appreciation of the conditions, these cases are becoming rare; it being more generally recognized that destructive results are preventable by early treatment; that is, by long-continued protection secured by rest and by effective mechanical devices. Proper management of these cases will result in the saving of a large number of these joints, even if the tubercular bacillus has secured a foothold in the osseous structures adjacent to the joint itself.

Much will depend upon the joint invaded; but the same principles of treatment will apply to all. The treatment may be summed up in the one word *rest*. This condition may be induced either by fixation, by extension, or by both. As a result, however, of the causes first enumerated many joints become so thoroughly implicated by the tubercular process that removal of the offending and dangerous foci becomes imperative.

Erasion (improperly termed arthrectomy) aims to remove by gouge and spoon and scissors the diseased hard and soft parts only; excision or resection goes a step further and takes away not only the implicated structures, but also an outlying area of bone; it is, therefore, still more radical, and aims to keep well outside of the disease. Amputation sacrifices a large portion of healthy tissue lying on the distal side of the diseased joint and is therefore still more mutilatory.

The proper application of these several operations to individual cases, therefore, demands a discriminating and judicious consideration. The decision will vary with the joint involved, the extent and character of the disease, the age and condition of the patient, the dangers of systemic infection, the risk to life, and the ultimate results to be obtained as regards locomotion.

As erasion is the least mutilating and is both theoretically and clinically so effective an operation, it has steadily grown in favor, especially as it renders possible the continuance of function in a considerable proportion of cases. It is also, as a rule, a less severe procedure; while it leaves excision and amputation, the two more radical operations, still in reserve. Even should the more serious operation follow, the loss of time especially in children, will be more than compensated for by the increased growth of the limb.

### WRIST AND ANKLE.

*Erasion.*—The ankle, wrist, tarsus and carpus may be considered in a single group, as the course of the disease in these joints is closely allied. The complicated character of the articulations involved makes extensive infection of the area very probable, and conservatism is almost universally recognized as the proper course of procedure.

The exclusion of all operative methods, as advocated by some authors, is unwise, and radicalism as to early amputation is equally wrong. A large number of these cases can be saved, and a useful walking member with movable joint can be obtained by the proper application of simple *erasion;* that is, the removal of diseased structures only and the continuance of proper mechanical appliances. Subsequent progression depends largely upon the situation of the foci. In an extra-articular ostitis that has involved cancellous tissue chiefly, the chances of securing good results by erasion without joint infection are excellent. By thorough removal and subsequent injection of anti-bacillary substances, arrest of the tubercular process is common. I have frequently secured excellent results by repeated gougings of small areas as they appeared, and the joint surfaces have entirely escaped contagion.

In young cases, where time is not a very serious matter to the patient compared to the benefit to be obtained, these repeated operations are most helpful, as excellent movable joints are thereby secured. In more serious cases, the disease will involve the tarsal or carpal articulations, and extensive removals may become necessary; yet, in many even of these cases the disease can be eradicated without loss of limb.

For these reasons, conservatism, even though carried to an extreme degree, is desirable, save in those cases where the tubercular process is intense and the resistive power slight; in the latter cases, amputation should be thoughtfully considered. In erasion, knife, scissors and gouge are to be employed until apparently normal bone is reached. Whenever it is possible to avoid the osseous structures underlying the cartilage the operation should be arrested, since cartilage is almost certain to die and implicate the adjoining articulation. It is impossible to be certain when all the invaded soil is removed; but fortunately, nature is able to overcome a moderate number of bacilli, and it is not well to open and invade any unnecessary articulation. When in close proximity to an articulation a certain number of cells, even though left behind will be destroyed by phagocytic action, or a second operation may be undertaken.

Portions of the tarsus and carpus which are liable to infection and can not be reached through the wound may be helpfully influenced by cataphoresis; that is by driving iodoform into the tissues by the positive pole of a battery, using a current of about 5 milliampères. By this method, or by hypodermic injections of iodoform in the region of the joint, the progress of the disease can often be arrested.

The incisions for erasion will vary with the site of the infected area, but for large removals I prefer the long lateral cuts as in excision.

The only guide as to the limit of removal is the extent of the disease. In children, the epiphyseal line should be avoided if possible. Unfortunately, however, in cases which demand excision, avoidance of this line is seldom feasible. The removal of the end of the tibia and fibula, together with the astragalus, necessarily shortens the leg very seriously, and ordinarily results in a stiff joint. In a large number of cases it is doubtful whether the patient is as comfortable as he would be with an artificial limb; practically nothing can be gained in growth if the lower epiphysis is removed.

In the carpus after operation, thorough fixation should be enforced by plaster-of-Paris, or other fixed dressing, which will prevent motion and relieve the resulting inflammation. Drainage, cleansing and local injections of sterilized iodoform oil (10 per cent.) are essential in the after-treatment.

At the ankle and tarsus, the inflamed parts must be absolutely protected from the weight of the body; not for an instant should a step be taken upon the diseased member. Crutches should be used, both before and after operation.

Thorough drainage is necessary and demands the most careful attention to prevent subsequent contamination which will increase the suppurative process. The great fault in such cases on the part of the surgeon lies in his failing to continue asepsis. A wound can escape contamination for weeks and even months, but only by the most scrupulous attention to the laws of cleanliness. I have seen chronic sinuses kept sweet for eighteen months, but it demands "eternal vigilance."

At the wrist the lateral incisions will frequently give good exposure, with the least injury to important structures.

For reaching the tarsus and carpus the only rule to follow is to avoid vessels, nerves and tendons as much as possible and yet secure thorough removal. Many surgeons employ one or two long dorsal longitudinal incisions with transverse cuts if necessary. If tendons or nerves are cut during the operation they should at once be sutured with sterilized silk or catgut chromicized. If one incision only is used at the wrist, it should extend from the middle of the first metacarpal well upward upon the radius. As tendons are divided the ends should be grasped with forceps, marked in pairs.

*Excision.*—A formal excision is desirable in more advanced cases where the process has advanced to large destruction of bone tissue, surrounding one or more of the articulations, where the general health presents evidences of succumbing to the disease, yet where there is reasonable hope of saving the limb from amputation.

The ankle or wrist joints are first involved ordinarily, although the tarsus and carpus may be primarily the seat. In the latter case, amputation is the more common, especially in tubercle-saturated patients.

In operating upon the ankle, the line of incision will vary with the exigencies of the case, but I have found that very satisfactory exposure can be made without injuring the vessels, nerves and tendons by two long, lateral, curvilinear incisions, which can be extended as desired by cross cuts when both the astragalus and malleoli demand removal. The peroneal tendons are difficult to hold aside, but can frequently be saved by using a retractor, or by carrying around them a thread of silk, which is less in the way of the operator. If divided, they should be sutured with silk or chromicized catgut. In the tarsus, I rarely make a cross dorsal cut (although the tendons can be sutured), as I am able to make a satisfactory atypical excision through long lateral incisions. I have never employed an osteoplastic operation, even when the os calcis had to be removed.

The most useful saw for joint-work is a key-hole saw made on the principle of Adams' blade, but with a longer cutting face. This can be easily managed and can be manipulated without injury to the surrounding parts. A strong, S-shaped bone retractor is also useful for lifting out the tissues and protecting them. A strong blunt knife is also of advantage in making the dissection.

*Amputation is often necessary in extensive destruction of joints and especially in adults.*

### KNEE.

In children under 12 years of age it is exceedingly important to preserve the epiphyseal line in order to secure growth for as long a period as possible. Erasion is, therefore, preferable to excision in all cases where it can be done effectually. The incision varies with different operators; I do not deem it of any special importance. My preference is the horse-shoe flap with the convexity downward, as stitching of the tendo-patella can be more easily accomplished than suturing of the sawed patella when the straight incision is employed, and better drainage can be secured than when the convexity of the flap is upward; moreover, it gives excellent exposure of the articular surfaces and thorough examination can be made. In some cases lateral incisions alone are sufficient to permit removal when the foci of disease are few. The spoon, gouge, knife and scissors should be thoroughly employed until all the diseased hard and soft tissues are removed; the hollow-handled flushing spoon being particularly useful to carry away the *débris*. Diseased synovial membrane throughout the bursa should be thoroughly removed even though patient search is required. Boiling water may be freely used to destroy the remaining bacilli, or the cavity can be filled with an alcoholic solution of acetanilid or a sterilized glycerin emulsion of iodoform.

In a few cases it will be possible to close the wound without drainage, but where purulent infection is decided, it would be better to drain with rubber tubing for at least a week.

In cases over 12 years of age, and in adults where the destructive process is not too extended, a formal excision is usually preferable, although erasion can sometimes be profitably employed, particularly where infection seems moderate. In the latter case, lateral incisions with scraping and drainage are rarely sufficient.

As to the incision, the same rule applies as in erasion. In an adult, particularly, the incision should extend well above the diseased bone, and all the foci should be gouged unstintingly. A butcher saw with reversed blade to saw from within outward, with proper protection of the parts beneath, is an excellent instrument. Occasionally, the key-hole saw answers nicely, but the angle of removal can not be so accurately determined as with a larger instrument. It is very important for the surgeon to train his eye to make the section at such an angle as to bring the tibia in good line with the femur without a second cutting. As a rule, the popliteal tissue will yield sufficiently to permit the straight position; but if there is still interference the contracted tendons can be divided.

The patella need seldom be removed unless diseased, as it is of service if the tendon is stitched *in situ.*

*Amputation.*—In children, the cases demanding primary amputation will be few; but occasionally the destruction of bone and joint by saturation is so extensive that removal is the only operation promising hope of life. In adults, the removal of the limb may frequently offer the best hope of life and of usefulness.

As to suturing of the bone, I prefer to trust to external appliances. If plaster-of-Paris is properly applied, good results can be secured, but a bracketed splint for adults is sometimes useful. A plaster cast can be freely opened on either side and the anterior and posterior halves can be removed for dressing, while the limb can still be held in good position without disturbance of the parts.

With thorough asepsis, dressings are infrequently required, and in children there is less disturbance and pain. Drainage tubes should be removed early. After healing, an apparatus should be worn until all tendency to deformity has disappeared.

### HIP.

The question of erasion at this joint is one which depends largely upon the amount of disease, the age of the patient, the amount of suppuration, etc. It certainly is an operation far less successful in this joint than at the knee, ankle or wrist.

In cases demanding early opening the pains are often severe and nothing short of complete excision of the upper end of the bone is advisable. In a few cases, however, where the exploratory incision demonstrates fairly good joint surfaces, the foci of disease may be removed by gouge, and the loss of bone substance and consequent shortening so frequently found in excision in young children may be avoided

In osteomyelitic cases this puncturing of the bone with subsequent drainage is useful.

The disadvantage of erasion lies in the fact that it is almost impossible to decide as to the limit of the disease, and the continuation of the process ultimately demands excision; the latter operation is therefore the one employed by the majority of surgeons, as its results are beneficial in shortening the time of suppuration, and a fairly good walking member is secured.

I realize thoroughly that operative interference tends to disseminate the tubercle bacilli and, if undertaken, the extirpation should be thorough; hence the desirability, as already stated, of complete removal.

The two most practical routes by which the joint is to be reached are the anterior and lateral incisions; the anterior incision is the most suitable for exploration and where sinuses have already formed in this region. This incision is made so as to interfere as little as possible with the muscular tissue, the cut being begun just below the anterior spinous process and extending downward as far as necessary, the object being to enter the joint between the sartorius and rectus on the one side and the tensor vaginæ and glutei on the other. By this route, both muscles and blood vessels are uninjured. When the neck of the bone is reached the capsule can be divided, exploration of the head, neck and rim of the acetabulum can be made, and the amount of the diseased bone decided upon. A strong blunt knife assists greatly in the process of clearing the bone, and the neck can be divided without injury to the surrounding tissue, with a narrow key-hole saw, guided and guarded by the finger.

The head of the bone is often with difficulty released from the socket. This may be accomplished before section of the neck by manipulation of the femur and the use of a blunt knife or, as I usually prefer, after section of the neck by grasping the fragment with strong lion-jaw forceps. The ligamentum teres, if intact, must be severed. I have found a flexible knife, which can be made to conform to the acetabulum, useful in dividing this structure. All the diseased structure should be removed from the acetabulum and the surrounding area with thorough flushing, and with perfect asepsis the wound may sometimes be closed and perfect union secured. The joint should be filled with iodoform oil. In bad cases both gauze and rubber drainage should be employed for the first few days, the gauze being removed at the first dressing, and the rubber tubing as rapidly as possible.

When the suppurative process is severe, a posterior opening may be made and thorough drainage instituted. This method is most useufl in the cases already described, or where the head of the bone has become separated and lies as a sequestrum.

In old or largely suppurative cases the lateral incision over the trochanter is desirable, as it gives a larger exposure of the joint, and when the trochanter is to be removed it is decidedly better. Whenever it is possible to strip off the trochantic attachments of muscles in a comparatively healthy bone, this method should be employed, as subsequent motion is thereby improved. As the femur is often extremely fragile in these cases where the ostitis has extended throughout the entire shaft, great care should be taken not to fracture the limb, especially in making rotary movements.

If the disease seems to have a definite limitation it will be better for subsequent locomotion to leave the trochanter, even if the drainage is somewhat interfered with by its retention. In these cases the drainage may be supplemented by a posterior opening, which often compensates for lost lateral space.

The power to steady the femur upon the pelvis is so important in locomotion that the retention of all possible muscles is essential, consequently I retain the trochanter whenever it is safely possible. I can show cases of excision when the femoral head and neck have been removed through an anterior incision, that can stand upon the toes of one foot without assistance and flex the thigh upon the pelvis beyond a right angle, can abduct and adduct the limb and have no deformity but shortening, a result which is a great improvement upon the condition attained after excision of the trochanter.

The majority of hip excisions, however, leave the patient a cripple for life, which readily accounts for the persistence with which many surgeons adhere to the conservative methods of treatment, and as an ankylosed limb in fair position is usually more serviceable for locomotion than an excised joint, the resection should not be undertaken until it is certain that suppuration will occur or that danger to life will ensue by delay.

The results to be feared are the exhaustion from long drainage, amyloid degenerations and general tuberculosis. While excision aims to remove the dangerous tubercular foci, yet the operation sometimes rapidly disseminates the disease. In a child with a bad antecedent history, an excision should be performed earlier than in a healthy child. Long continued, or very profuse suppuration also calls for surgical interference to avoid waxy degenerations. When in doubt, an exploratory incision is advisable, especially if suppuration is present.

In general, a case which is progressing unfavorably in spite of good mechanical treatment, with evidences of systemic infection, demands interference. Acetabular disease, when manifested by suppuration within the pelvis, is best arrested by thorough removal and drainage. Amputation is usually reserved for adult cases with old and suppurative sinuses and marked caries.

### ELBOW.

In this region, erasion is decidedly the best operation for young children: by careful gouging of the diseased areas a very fair member can be secured. Whenever possible, the attachment of the biceps and triceps should be left intact. When the entire bone must be removed the retention of the periosteum, (if healthy) at the points of muscle insertion is advantageous. Quite frequently the cancellous tissue of the olecranon can be gouged without disturbing the insertion of the triceps.

The incision for erasion may be lateral, but a focus in the ulnar is rapidly reached by a cut made directly over the olecranon. For formal excision, a posterior long incision directly over the olecranon, or two lateral posterior ones with cross cut, will give good exposure and save also the ulnar nerve.

The head of the radius is liable to disease, but section of the neck will often permit retention of the biceps. I have not found much difficulty in drainage, even when I have sawed through the olecranon and left it *in situ*. For excision, the narrow saw and ronguer forceps are the most useful instruments in addition to the gouge and curette. Care must be taken to remove every particle of diseased tissue, whether excision or erasion is employed, and the parts should be flooded with bichlorid and afterward with iodoform oil and other antibacillary substances.

Drainage tubes should not be retained too long. Plaster-of-Paris makes the best subsequent dressing, as the cast can be made thick at the bend of the elbow by longitudinal reverses, thus giving strength to the dressing when the windows are cut. Amputation is seldom required except in adults or in the worst class of cases.

### SHOULDER.

The rarity of tubercular disease at this joint makes it difficult to speak with certainty as to definite results. My personal experience has been so limited that I can not speak from that standpoint, but my opinion is that erasion is decidedly the best operation for this region, and that it should be done as early as possible, as soon as the presence of pus is determined, The incision should be made so as to avoid as much as possible, interference with subsequent muscular action, and the vessels and nerves should be left unmolested. I have never seen an amputation for this condition.

### CONCLUSIONS.

1. When operative measures are demanded, erasion is the preferable procedure, as it gives less subsequent deformity and results in better locomotion. This operation is especially applicable at the ankle, wrist and shoulder, frequently at the knee and elbow; rarely at the hip.
2. Excision is most useful at the hip. It is also

largely employed at the knee and elbow; more rarely at the other articulations.

3. Amputation should be employed in rapid and extensive degenerations at the ankle, knee, wrist, elbow, and in old hip cases which have relapsed after excision.

4. In children, the less mutilatory operation should be first employed, even though repetition is required; but in adults, temporary operations are seldom advisable.

5. The necessity for operative treatment in joint diseases arises from neglect of proper mechanical measures. Protection and fixation of the joint in the early stages of tubercular invasion will nearly always result in a cure with movable joint and good function. These measures together with antibacillary injections and cataphoretic in-driving of iodoform are steadily decreasing the number of cases demanding operation. Motion and traumatism are the chief causes of inflammatory complications in tubercular ostitis, and often result in such an amount of suppuration and loss of bone as to demand removal of the diseased tissues.